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ABSTRACT

Project TEAM--Teacher Education for the Approaching
Millennium--represents an educational partnership designed to improve science
teacher preparation, content knowledge among both students and teachers, and
the desire to better connect the theoretical constructs offered in a science
methods course with the practical concerns expressed by students during an
in-school clinical experience. This paper discusses the TEAM participants,
program goals, implementation, and evaluation. (WRM)

Project TEAM: Bridging Theory and Practice in Science Teacher Preparation

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PROJECT TEAM: BRIDGING THEORY AND PRACTICE IN SCIENCE TEACHER PREPARATION

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What is Project TEAM?

Project TEAM--Teacher Education for the Approaching Millennium, represents an partnership designed to improve science teacher preparation, content knowledge among both students and teachers, and the desire to better connect the theoretical constructs offered in a science methods course with the practical concerns expressed by students during an in-school clinical experience.

As a systemic partnership bridging theory and practice in science education, Project TEAM recognized at the outset the challenges of connecting university models of best practice with the realities of the school setting. By involving the cooperating teachers in the beginning of the program and having them provide models of the best practice-- ranging from pedagogy through lesson planning-- a strong and vibrant connection between methods course theory and classroom practice were seamlessly fused.

The content materials used were an extension of Operation Primary Physical Science (OPPS) program. OPPS is attempting to meet the challenge of providing exemplary staff development materials for elementary teachers, assisting them in the development of their science content knowledge. The physical sciences represented the area of emphasis for the OPPS materials, and a strong commitment to learning by doing-- a constructivist approach--is evident throughout the program. Teachers learned fundamental physical science topics ranging from magnetism through sound by engaging

in tasks that forced them to frequently ask the question "why?" and though investigation, obtain an answer.

Meet the TEAM Institutions

Three institutions were involved in Project TEAM. Northern Illinois University, located in DeKalb, IL, offers a large teacher education program, with approximately 250 graduates yearly in Elementary Education.

School district U-46, in Elgin, is the second largest school district in the state of Illinois. It is a large and varied district, with a large number of students from underrepresented populations and a wide range of socioeconomic levels. In 1998, U-46 served over 34,000 students. The district reported that approximately 66 different languages were noted among U-46 students in a recent bilingual census. Approximately 26% of U-46 students are of Hispanic origin, 8% are African-American, 6% are Asian-American, and less than 1% are Native American.

St. Joseph's, a Parochial School in Elgin, serves the same community, with an even higher (approximately 50%) number of the students enrolled as members of underrepresented populations.

Common Goal

Uniting these institutions was the overall goal of the project. Promoting a more sophisticated understanding of scientific literacy formed the strand that connected the interests of the participants in Project TEAM. For preservice teachers, developing their science content knowledge and teaching skills offered the first issue of concern.

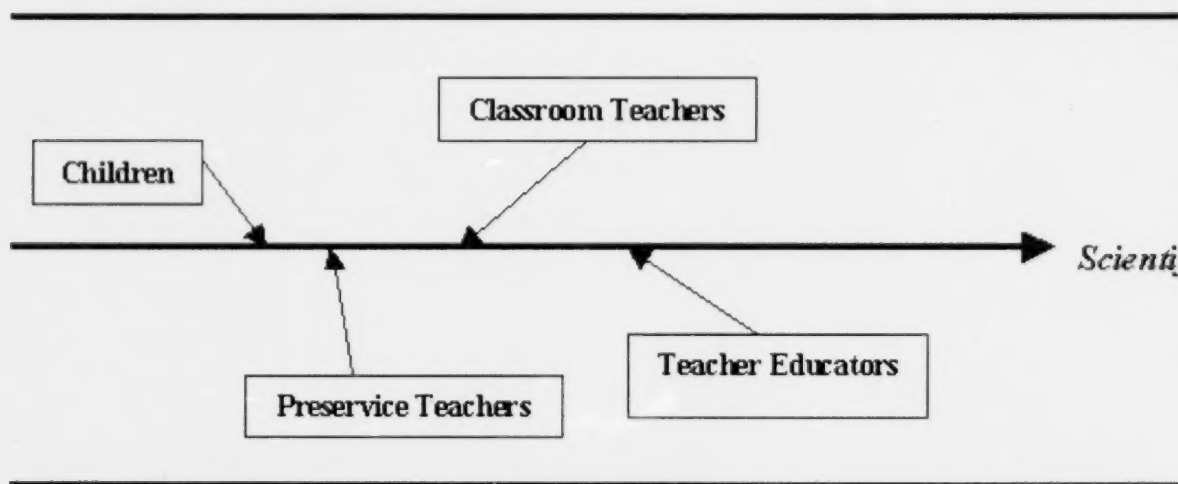
Classroom teachers also shared in the overall goal of improving scientific literacy. In addition to enhancing their own knowledge, their role as classroom teacher and mentor

teacher to the preservice teacher offered them two audiences to work with, in addition to their own professional growth.

Elementary school children represented the third part of the program, with all of the teacher education and science education goals designed, in principle, to help better meet their needs.

All of the participants in Project TEAM were considered to have some knowledge of scientific literacy. The concept, scientific literacy, was envisioned as a continuum, with some stakeholders possessing more knowledge than others. Project TEAM's objective was to move each participant as far to the right (as shown in Figure 1) as possible. It was recognized that all participants started at different points along the continuum, and each would move different distances, but it was anticipated that all would experience professional growth by the end of the project.

Figure 1. Scientific Literacy Continuum



Teacher Education Model

Project TEAM, then, was developed to provide a model for teacher education. The challenge of connecting theory with practice is one that has been writ large over the face of teacher education. By serving the needs of preservice teachers, practicing teachers, and ultimately children, Project TEAM bridges that gap in important ways.

What are the TEAM Objectives?

Project TEAM addresses a number of objectives related to staff development, science knowledge, clinical teaching settings, and educational partnerships. To provide staff development for teachers represented one of the key areas of interest in developing Project TEAM. Recognizing the call for enhanced content knowledge among teachers (NRC, 1996; AAAS, 1989), the development of the teacher's content knowledge represented the first phase of the program.

Development of the teacher's knowledge base was accomplished in large part through the use of materials developed at Louisiana State University (OPPS, 1996a, 1996b). The materials, comprehensive sets of documents supporting teacher learning in the physical sciences, were designed to be completely inquiry-based in approach. All movement along the scientific literacy continuum in terms of enhanced content knowledge will be obtained through the learner interacting with materials and developing their own understanding through interaction and the guidance of the staff development team.

To write physical science units provided the second objective for Project TEAM. Recognizing that the good efforts accomplished during the content knowledge workshop might be wasted if not directed toward improved student learning, the teachers of Project

TEAM-constructed instructional units (under the guidance of the science educators who presented the content knowledge workshops) for use in their classrooms with their students. The knowledge gained in the content knowledge workshop was used to provide the basis for the new instructional units, showcasing the teachers' enhanced knowledge base.

The units were used in conjunction with the existing teacher education program to improve the relationship between the methods course instruction and the clinical experience. To further this connection, the supervisor for the clinical experience served in two additional capacities: as one of the Project TEAM workshop facilitators and as the instructor for the preservice teachers during their science methods course. Together, these three strands connected the theory of the university with the practice demonstrated in the public schools

The clinical experience also served to develop and to promote a teacher education partnership between the university and the Elgin school district. Using the teacher education program, staff development for teachers, and using the skills-enhanced teachers as the mentors for the student teachers provided the opportunity to address the individual needs of all of Project TEAM's constituents. Each participant was afforded the opportunity to grow professionally, moving along the scientific literacy continuum identified earlier to foster a greater connection with the tenants of scientific literacy.

What are the Major Components of Project TEAM?

The three essential strands of Project TEAM are related to the following: improving teacher's content knowledge, developing exemplary units for science instruction, and

applying this new knowledge and these curricular materials in mentoring preservice teachers.

Content Knowledge

Teachers were offered choices from among four sets of topics: 1) Magnets, 2) Solids, Liquids, and Air, 3) Light, Shadow, and Mirrors, and 4) Sink or Float. These topics were selected because they represented typical topics encountered in the elementary education science curriculum. This fit well with the needs of the Elgin district, as they had recently selected FOSS as their district's science curriculum, and desired staff development training to assist in this endeavor. Teachers were to select two topics from the four content workshops, and instructional units were to be developed based on the composition of the workshops. It is worth noting that some teachers attended all of the workshops.

The workshops were structured from a constructivist/inquiry-based approach. All experiences were to be developed from the teacher's interaction with materials and guidance from the workshop's facilitators. To develop the science content knowledge, no direct instruction was offered. In the words of one of the participants, the experience helped them to better perceive the "difference between telling and knowing." The workshops were structured in this manner both in deference to the learning needs of the teachers, but also as a means of modeling the sort of practice that student teachers will be seeking during their time in the clinical setting.

Creation of Exemplary Units

During the summer workshops, teachers were asked to attend four sessions related to the development of their instructional units. Topics during the summer workshops

were 1) science process skills, 2) interdisciplinary teaching, 3) assessment, and 4) infusing technology into instruction. Each workshop was offered twice, allowing for teachers to participate in traditional summer activities as well as to attend the workshops.

The content of the workshops was designed to help teachers be cognizant of the experiences of the student teachers who would be arriving during the fall and spring semesters and that would be team teaching the content of the units with the teachers when they arrived for their clinical experiences. In particular, the needs to develop pedagogy consistent with best practice in science education and to develop authentic assessment approaches were topics welcomed by the Project TEAM teachers as well.

With these skills established, the teachers of Project TEAM used these skills in conjunction with the content knowledge from the spring workshops to develop exemplary science units.

Teacher Education

During the Fall 1998 and Spring 1999 semesters, students from a Northern Illinois University science methods class spent three weeks in the classrooms of the Project TEAM teachers. During this time, they team taught the instructional units created during the previous summer by the project's teachers.

Their supervision was carried out, as mentioned previously, by one of the project's facilitators, who observed their science teaching experiences during the progress of the clinical experience.

Thirty preservice teachers were involved during each semester. Twenty five of these students interacted directly with mentor teachers involved in Project TEAM; five

experienced exposure to the Project TEAM materials during the science methods course, but not during the clinical experience.

The clinical experience took place during the same semester as the methods course; however, on campus classes were suspended during the time the students were in the field engaged in the clinical teaching experience. The methods course instructor also served as the field supervisor, using the time when on campus classes were suspended to make field visits and gauge the progress of both the mentor teachers and the preservice teachers. During the fall semester, he was able to meet with each of the students twice during a three-week time period. The same schedule has been proposed for the spring 1999 semester.

Findings

The findings by Project TEAM's evaluator were most encouraging. The participating teachers demonstrated improvements in a number of areas. First and foremost, they demonstrated a significant improvement in their science content knowledge. This was demonstrated by responses to open ended questions and through the complexity of concept maps developed by the participants.

From the teacher education perspective, the participants demonstrated improvement in their understanding and application of using science education standards for lesson planning, planning units conceptually.

Learning From the Past: Project TEAM's Evolution

Project TEAM has evolved during its tenure. During the first year of its implementation, it invited participation from two school districts and a parochial school. The content knowledge workshops and the creation of two interdisciplinary units took

place during the same time period, the summer of 1997. Several findings came from this experience. First and foremost, the challenges of training and producing the interdisciplinary units during the summer were quite overwhelming. Teachers struggled to infuse their enhanced content knowledge into their units over the course of a six-week period and then to compose a unit during the fall semester. The second unit was even more problematic, as the compositional demands came into conflict with the teacher's workload during the fall semester.

An additional concern arose as a consequence of working with multiple school districts. The challenge of presenting the content knowledge was challenging, as each of the districts had different perspectives on when and where the content knowledge should be introduced to students within their respective districts' curriculums. The focus of the workshops were on the development of physical science knowledge in primary teachers; for districts that presented the content information to students in the intermediate grades, the workshop was not as effective in serving their needs.

In response to those issues, Project TEAM offered the content knowledge workshop during the spring of 1998 and an additional workshop on science teaching pedagogy during the summer session of 1998. This allowed for the teachers to better consolidate their content knowledge gains during the spring and infuse the new knowledge into instruction.

In addition, working with a single school district allowed for the content knowledge to be better connected with the curriculum of a single district. U-46, which had recently adopted the FOSS program, found the content knowledge workshops and curriculum development time during the summer to better meet the needs of their staff.

Plans for current year

For the coming year, Project TEAM again received funding to continue. Based on the experiences of two previous cohorts of teachers participating in the project, a number of changes have been invoked for the 1999 series of workshops.

First, the facilitators will extend opportunity to twice the number of teachers. Rather than working with 25 teachers, 50 teachers will participate in Project TEAM during the 1999 session. In addition, the number of instructional units created by each teacher will be reduced to one from the previous two. It was determined that the returns expected from having teachers produce two units were somewhat diminished by the effort required to compose two units. This will allow the participants to focus all of their efforts on a single unit, rather than two. Finally, the opportunity to impact more students was recognized as an important consequence of this project. Doubling the number of teachers will double the number of elementary students who may benefit from the program.

Future Considerations

Partnership opportunities are recognized as one of the key issues to hopefully emerge from the work piloted through the Project TEAM experiences. The value of a partnership that provides opportunities for personal and professional growth for both the preservice and practicing teachers is essential.

Developing a group of mentor teachers for the clinical teaching aspects of the university's program represents a long-term need and consequently a long-term goal of the project. The teachers involved in Project TEAM find that their experiences

mentoring the student teachers to be important parts of their own professional growth and development.

Acknowledgments

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